DISTRIBUTION AND RARITY OF *ERYTHRONIUM PROPULLANS* OF MINNESOTA, WITH COMMENTS ON CERTAIN DISTINGUISHING FEATURES

Thomas Morley

Department of Botany, University of Minnesota, St. Paul, 55108

ABSTRACT

The following topics are discussed for *Erythronium propullans*: major distinguishing morphological features, details of leaf shape, habitat, soil preference, distribution, point of origin, colony formation, rarity, and state of preservation.

Erythronium propullans Gray is Minnesota's only endemic species of flowering plant. Two other species of the genus also grow in the state, *E. albidum* Nutt. and *E. americanum* Ker., but whereas these are both widespread, *E. propullans* occurs in only two counties. Of the other two species, only *E. albidum* grows in the same region as *E. propullans*, often mingling freely with it. For twenty years off and on I have been searching out the localities of the endemic, and I believe most have been found by now, although a few may remain undiscovered. Therefore it seems an appropriate time to report on the distribution and rarity of the plant, especially in view of the pressures for development on the region concerned. Details of certain characteristic features of the plant and other related matters are also described herein.

The species is distinctive. As noted above, in its distributional range it could only be confused with *E. albidum*, and from this species it can easily be separated when in flower or fruit. The distinctive morphological features of *E. propullans* are: (1) the original bulb does not produce offsets as in *E. albidum*, but rather vegetative reproduction is accomplished by the production of a single offshoot which appears on the stem of the flowering plant well above the bulb; (2) the leaf apex tapers more gradually on the average than in *E. albidum*, producing a sharper point which often appears pinched or inrolled at the tip; (3)the flowers are smaller than those of *E. albidum*, are pinkish compared to the usually whiter flowers of the other species, and are more variable in numbers of parts; and (4) the fruits are smaller and rise only to an approximately horizontal or below horizontal position from the nodding attitude of the flower, whereas the larger fruits of *E. albidum* become erect.

In order to determine more accurately how different the leaf shapes of the two sympatric species are, measurements were made on living plants of both at ten different sites. Separate records were kept for (1) the lower and larger leaf of the two leaves on the flowering plants,(2) the upper and smaller leaf, and (3) leaves on non-flowering plants. The most useful measurements were found to be the leaf width and the included angle of the tip. The angle measured was that of the whole end of the leaf, not measuring any inverse or concave curve that might be present just below the apex but rather measuring to the tissue below it. The results are shown in figs. 1, 2, and 3. It will be seen that the differences between the species are greatest in the large lower leaves on the flowering plants and least on the leaves of the sterile plants. Tracings of fresh leaf tips of the lower leaves from both species are shown in fig. 4. Some overlap in form exists between the two kinds, but generally the shape is a usable character.

At the leaf apex the two edges are incurved and come together to form a small solid tip, round in cross section, which is elongate and rod-like to some degree in many plants, mostly those of E. propullans. This tip is 0.8-3.5 mm long in E. propullans, and 0.5-1.8 mm long in E. albidum.

The habitat of E. propullans is most commonly a wooded north-facing slope 15-27 m high rising above or near a stream bed, the latter either of a present stream or of an old abandoned channel. The plants usually occupy the lower part of the slope and may extend out onto the flood plain if one is present, even crossing to the far side of the stream sometimes. Less often they climb nearly to the top of the slope. At one location the slope is only about 4 m high. Sometimes the exposure is northeast or northwest or even, rarely, east or west. At two sites, Kenyon and Cannon Falls, the plants are scattered on the flood plain only and are so far north of the slope that there may be no relation to it, and a third place now destroyed was similar. The Cannon Falls location is on the north side of the river, and although apparently suitable habitat occurs on the south side, nearer the foot of the slope, no plants are found there. Therefore one has to conclude that the plants can succeed in the absence of a north-facing slope under the right conditions.

The plants occur most often in moderate to heavy shade. The shading trees are deciduous, of many kinds. Occasionally plants will be found in the open, apparently after tree removal, yet they appear to survive well enough. Elms were common cover trees and are now mostly dead or dying; the effect of their loss is yet to be seen. Cattle are often pastured in the habitats of these trout lilies, but the plants appear to stand up well under light to moderate grazing. They may persist in the open and in the presence of grazing after many other herbs have disappeared. Possibly

this success is only because the cattle aren't introduced till after the plants have nearly completed their life cycle for the year.

Plants of E. propullans appear to grow best in undisturbed places with at least a surface layer of rich black well-aerated humus soil. However, once established, they appear to withstand moderate disturbance rather well, as implied above in relation to grazing. The flood plains inhabitated are subject to occasional siltation at long intervals. The plants can be found not infrequently in rather sandy and almost gravelly soil.

Soil surveys have been published by the USDA Soil Conservation Service for both Rice (March 1975) and Goodhue (Oct. 1976) counties, the counties in which the endemic grows. At one trout lily site, that at Kenyon, there is evidently a correlation between soil type and distribution of the plants. Here the plants grow on a strip of relatively well-drained alluvial soil brought in apparently by a tributary entering from the south, and they appear to avoid the poorly drained silty clay loam of the main valley of the North Branch of the Zumbro, a soil type occurring both upstream and downstream from the trout lily area. For the rest of the sites, however, no correlation is apparent between distribution of the species and soil type. Often the trout lily locations fall in areas merely identified as "rough broken land". When sites do fall in definite soil types, no pattern of selectivity is detectable that would explain the limited distribution of the species. Soil characteristics for the different types are given rather generally and do not permit close comparisons of structure and chemistry. Properties given for the soil types occupied by E. propullans vary from loamy to loamy sand or sandy loam, from well-drained soils to those moderately so, from soils with a high organic content and fertility to those with moderate ones, and from neutral soils to slightly acid ones.

The factors limiting distribution of the species remain unknown. Sites in nearby regions with apparently suitable topography, vegetation, and soil lack the plant. So much of the surrounding countryside has been cut and cultivated that it is not even certain that the present situations, on slopes and floodplains, were the only ones ever occupied. The apparent preference for north-facing slopes suggests a plant better suited to cooler climes, but if so one would of course expect it to occur farther north, which it does not. Its chosen sites, although moderately sheltered, are still too warm and exposed for it to be a stranded lost element of the northern conifer zone. As examples of speculation it could be suggested that the plants may be trapped between a need for summer coolness and winter warmth; or that they originated under cooler conditions but that their reproductive or dispersal system was too inefficient to permit spread-

ing much to the north as the climate warmed or spreading in any direction if climatic change was not involved; or that subtle unknown differences in microclimate or soils are controlling.

Figure 5 shows the known distribution of E. propullans. The largest and best sites occur along the Straight and Cannon rivers, all within or not far from the city of Faribault. I have searched but cannot find the plant in adjoining counties. The association of the plants with streams, very plain on the map, reflects largely the local topography. Steep slopes are rare in that part of the country except along streams. However, there is a possibility that floodwaters played a part in spreading the species from place to place. It will be noted that all the locations east of Faribault are on streams that head up not far from that city. It looks very much as if the species spread from the Faribault area where it is now most abundant. Appearances also suggest that the plants may once have occupied certain parts of the upland to the east where they presumably have since been eradicated, and that from there they produced disseminules which were carried down the streams to the east and northeast. The sites farthest downstream, at Kenyon and Cannon Falls, are only on floodplains, not slopes although slopes are present, which would agree with the notion that there is something peculiarly suited to the species in the upland soils of the Faribault area. The Zumbrota site has not been relocated. Uplands accordingly would be the primary habitat of the species, the floodplains secondary. If the plants never occupied parts of the now cultivated lands east of Faribault, one would have to suppose that some dispersal agent carried seeds either to the headwaters of the streams or directly to the present locations.

Lest it be thought that the city of Faribault itself might have influenced the environment favorably for E. propullans, it should be pointed out that the city is small and that one of the best areas for the species is about 1.5 miles northeast of town, well beyond any likely influence.

The point of origin of E. propullans is not clear. Two main options seem available: either the species originated in the Faribault area after the departure of the glaciers about 13000 years ago, or it existed before that time and shifted position with the changing climate. I think the evidence favors the former explanation, for the following reasons: (1) the plants seem to have a narrow range of acceptable habitats and to require a rather exact set of environmental conditions which would have been hard to duplicate over a wide area as would be necessary for successful migrations; (2) they appear to be slow spreaders, a poor quality with which to face climatic change; and (3) the appearance of having spread eastward from Faribault is not the pattern one would expect from a plant shifting north and south with the climate.

However, phylogenetic data for the genus must be considered before conclusions can be drawn. And the time span seems too short.

Although the vegetative reproduction system of the plant is modest, the plants nonetheless do tend to form clones in the form of irregular clumps or colonies. The colonies are usually 2-5 dm or more in diameter, although they may be smaller or the plants may be scattered individually. In some situations colonies tend to form at or around the bases of trees but in general this is only occasional. One can make a rough estimate of the abundance of the species at a given site by counting the colonies, saving the trouble of counting individuals. 25 sites are known. The largest ones have about 110, 69, 62, 39, and 20 colonies, and the rest carry from about 15 to one each. A very rough estimate of the total number of colonies in all known locations comes to a little over 400. A conservative estimate of the average number of individuals per colony would be about 20.

One of the interesting aspects of the endemic is the fact that the majority of the plants in a colony will usually bloom, whereas the opposite is true of E. albidum. This behavior of E. propullans appears at least superficially to be a compensation for its very limited vegetative reproduction in contrast to the other species. Whether the nearly full flowering has been maintained from a primitive condition or developed secondarily is not clear. Miss Jody A. Banks, graduate student at the University of Wisconsin at La Crosse, has recently studied the reproductive biology of the endemic and will report her findings in due time.

Two sites are believed to have disappeared some time ago. I could not relocate the Zumbrota plants, which are represented in the University of Minnesota herbarium by an 1892 collection, and I believe them to have been eliminated by growth of the city. A plowed field at the foot of a bluff about 1.5 miles northeast of Faribault is in prime territory for the species, and I think the ground must originally have produced many of the plants.

How uncommon should this species be considered, and are there any threats to its existence? Although the plants are indeed abundant within a few small areas and are moderately well dispersed in the two counties, I think an overview will support the opinion that E. propullans is a very uncommon or rare species. Its preference for rather steep north-facing slopes has tended to spare it, but the plants are now increasingly in danger of destruction largely because the best localities are within the Faribault city limits or less than two miles from them. The city is expanding, and the bluff tops above the slopes are becoming desirable as house sites. Homes have already been built above two of the smaller locations and threaten one of the medium sites. A locality with a few colonies southeast of Faribault was wiped out by a road recently, and another in the same direction but

within the city limits has been largely destroyed by motorbikes. Several large colonies on relatively flat land at the foot of the bluffs about 1.5 miles northeast of Faribault have recently been plowed under, as a farmer converted from pasture to crop land. A program for protection of the species is therefore a necessity.

One of the sites with roughly 20 colonies, near Kenyon, has been acquired for preservation by The Nature Conservancy. The Conservancy is also making efforts to bring about protection of the bigger localities in and near Faribault, with the help of interested persons in the city, and prospects of success are fairly good at the moment. A 62 colony site in extreme southeast Faribault seems assured of protection, and there are hopes of saving some of the other locations. However, more losses will probably be suffered before the situation stabilizes.

Unfortunately, there is an element of danger in giving publicity to a project of this kind. Although the plants are small and the flowers inconspicuous, they appeal to some garden lovers and are probably subject to theft by a few people. Therefore the necessary steps of preservation should be undertaken with circumspection and without publicity.

Scientists wishing to work with the species naturally should refrain from doing any but the most minimal damage. Populations have been established at the University of Minnesota Landscape Arboretum near Chanhassen and at the Eloise Butler Wildflower Garden in Minneapolis, the latter population quite small. This cultivated material might be adequate for the use of the serious student; he should seek permission from the directors.

Selected References

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Rosendahl, C. O. 1919. Variations in the flowers of Erythronium propullans Gray. Torreya 19: 43-47.

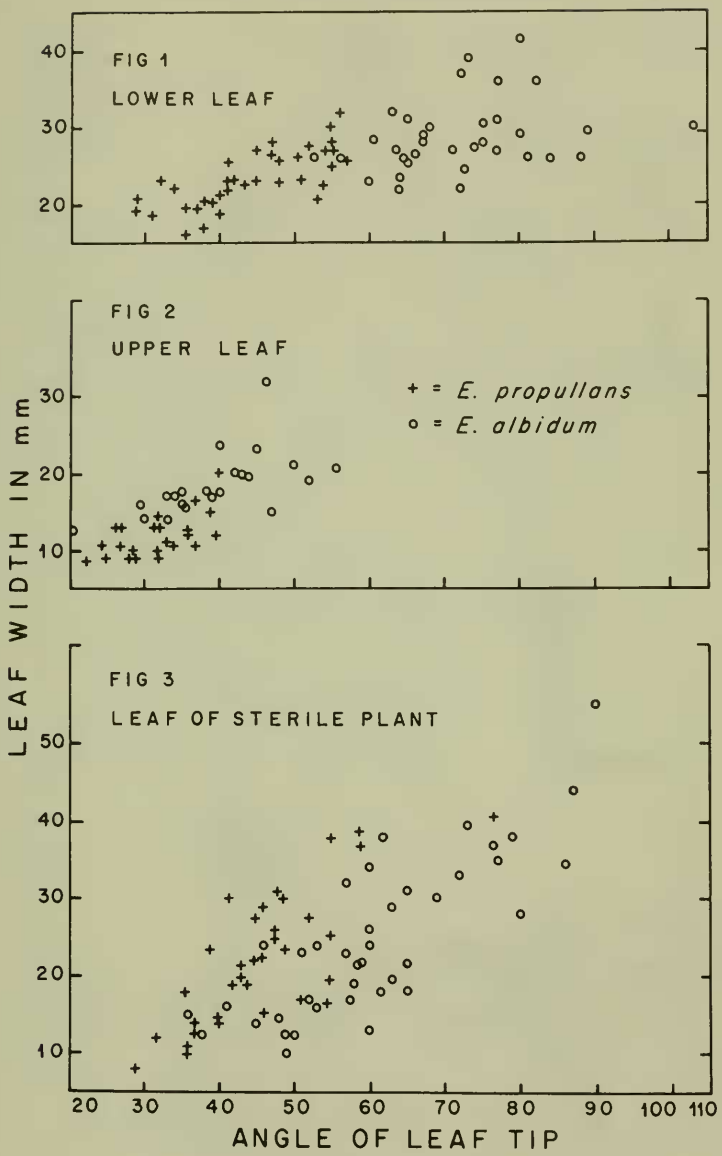
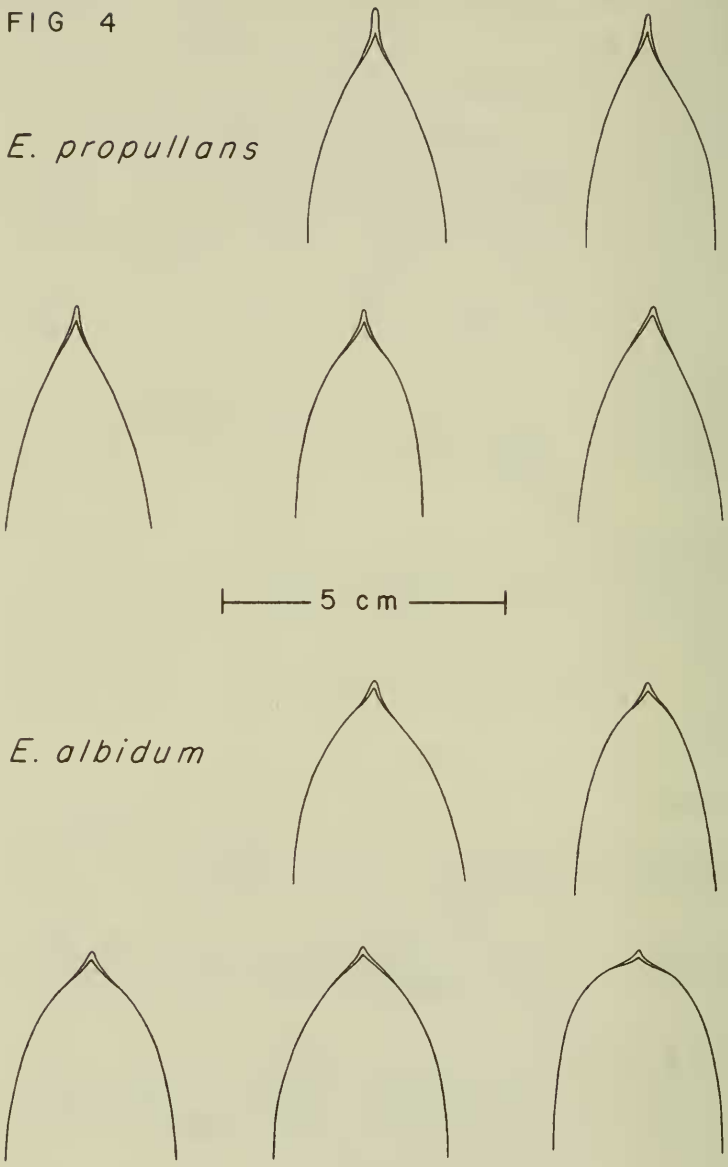


FIG 1
LOWER LEAF
FIG 2
UPPER LEAF
+ = E. propullans
o = E. albidum
FIG 3
LEAF OF STERILE PLANT
LEAF WIDTH IN mm
ANGLE OF LEAF TIP
20 30 40 50 60 70 80 90 100 110
10 20 30 40 50

FIG 4



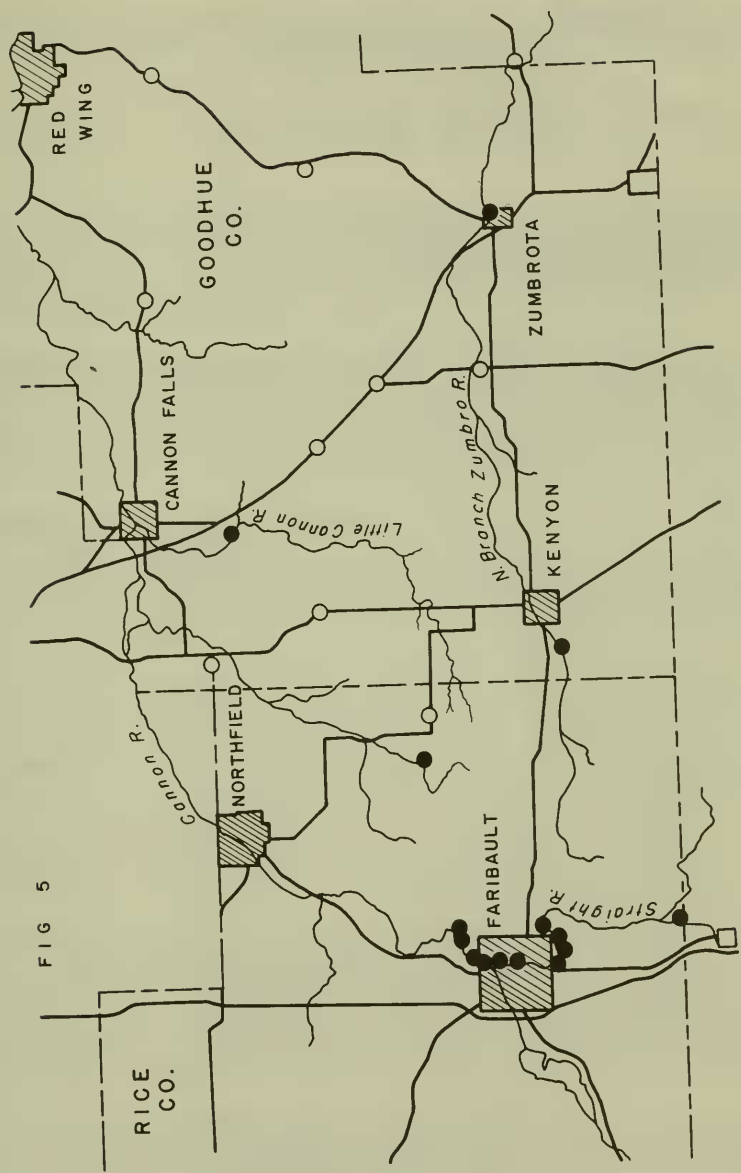

RED WING
GOODHUE CO.
CANNON FALLS
Little Cannon R.
ZUMBROTA
N. Branch Zumbro R.
KENYON
NORTHFIELD
Cannon R.
FARIBAULT
Straight R.
RICE CO.

FIG 5